

# Laurens County Tornado of 13 January 2005

## Survey and Assessment of Storm Damage

### 1. Summary

A tornadic thunderstorm crossed Laurens County, South Carolina during the evening of Thursday, 13 January 2005. The town of Laurens is the county seat of Laurens County. Laurens is approximately 32 miles southeast of WFO Greenville-Spartanburg.



Fig. 1. County map of South Carolina. The location of WFO Greenville-Spartanburg is identified by the star. The oval shows the approximate location of Laurens. The arrow depicts the storm track.

A Tornado Watch was issued at 540 pm EST on 13 January. A Tornado Warning for Laurens County was issued from 702 pm EST until 745 pm EST.

Following is an approximate chronology of the WSR-88D mesocyclone (and Tornadic Vortex Signature) position along a track from southwest to northeast across the county:

|  |                             |
|--|-----------------------------|
| Entered Laurens County from Greenwood County.... | 705 pm EST                  |
| Moved through the Ekom community.....            | 713 pm EST ... First damage |
| Crossed the Laurens High School area.....        | 722 pm EST                  |
| Moved just west of Ora.....                      | 732 pm EST ... Last damage  |
| Departed Laurens County near Enoree.....         | 738 pm EST                  |



Fig. 2. Diamond markers and straight line indicate locations of tornado damage. The storm traveled from southwest to northeast. The damage at each mark is discussed in the text.

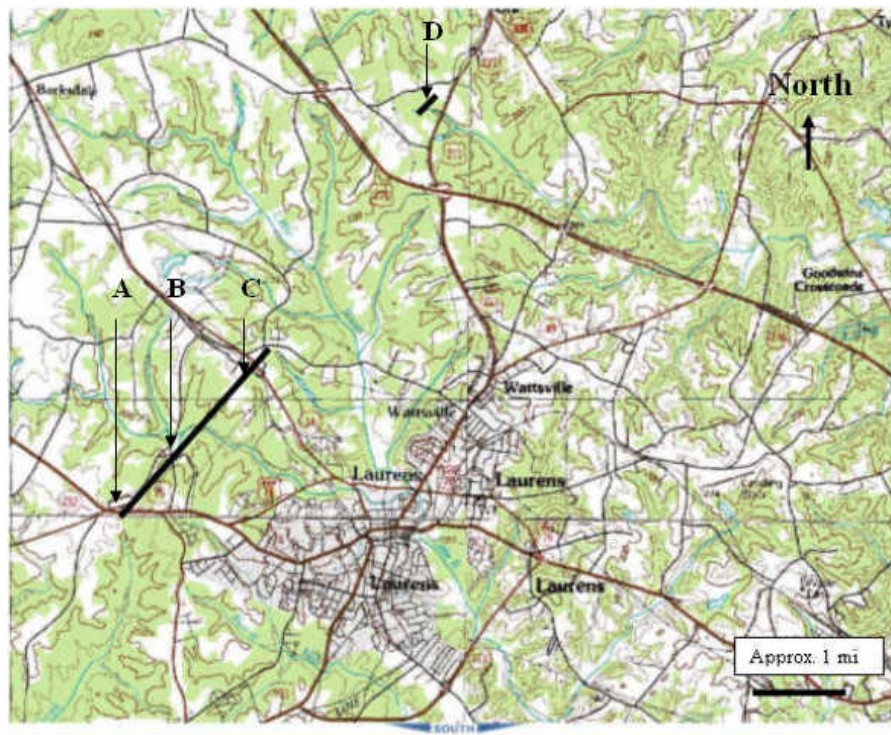


Fig. 3. Map of the Laurens vicinity showing tornado track from near Laurens High School northeast to just north of S.C. 14. The high school is near the tip of arrow A. Damage also occurred at TNT Logistics near the tip of arrow D. The damage near Ekom is not depicted on this map.

The first known damage caused by the storm occurred in the Ekom community, approximately 10 miles southwest of Laurens, where two mobile homes were damaged. Based on the radar location of the mesocyclone and TVS, this event occurred at approximately 713 pm EST. Damage along the storm's track was not reported or observed again until a point was reached one quarter to one half mile south of U.S. 76 near Laurens High School. On the south side of U.S. 76, a number of trees were blown down and others were snapped in half. Small sheds were destroyed and a portion of a roof was removed from a house.



Fig. 4. Damaged structures near Laurens High School. Note the destroyed mobile home. The school is approximately 170 yards to the left of the left edge of the picture. Photograph from WYFF-TV.

On the north side of U.S. 76, some wind damage occurred on and near the Laurens High School grounds. A portion of the roof of a relatively new concession stand was removed. The concession stand appeared to be a well-built brick or concrete block structure with a metal roof (Figure 6). The primary wind effects were confined to the eastern edge of the school property. Photographs from the WYFF-TV helicopter show major damage to the roof of a building of unknown structural characteristics. A nearby mobile home was destroyed (Figure 4). The building and mobile home are a couple of hundred yards east of the school. A house less than 50 yards from the mobile home did not sustain obvious damage. Most of the damage in this area is consistent with F0 and F1 intensity. The destroyed mobile home offers some evidence that F2 intensity was attained. The width of the storm damage on U.S. 76 (bordering the school property on the south) was approximately 0.2 mile (350 yards).





Fig. 5. Picture taken from U.S. 76 in front of Laurens High School. View toward the northeast where smoke from the TNT Logistics fire is visible. NWS photograph.



Fig. 6. Damage to concession stand at Laurens High School. Photograph courtesy *The Greenville News*.

A damage track extended from the high school area northeast through woods to Whelon Road where many large trees were uprooted and moderate damage to a frame guest house was observed. (Tip of arrow B in Figure 3.) It was not possible to differentiate wind damage from tree damage on the guest house. The main residence, approximately 100 yards to the northwest, was not significantly damaged, but a tractor parked nearby was toppled. The aerial view in Figure 10 clearly shows the direction of the strongest winds which occurred on the right side (relative to the direction of motion) of the tornado. Nearly all of the trees are pointing toward the northeast. A close examination of the tree damage reveals several trees were uprooted or snapped by a wind with a westerly component. Also, the trees that fell toward the east are on top of the trees aligned with the primary wind flow. The layering of debris with varying directional distribution

indicates that the westerly winds occurred after the southerly winds produced most of the damage. This sequence of tree damage corresponds to that expected with a cyclonic circulation moving toward the northeast.



Fig. 7. Downed trees and a damaged structure near the pond on the west side of Whelon Road. NWS photograph.



Fig. 8. Trees uprooted along the north side of the pond on the west side of Whelon Road. NWS photograph.



Fig. 9. Another view of the tree and structure damage on the west side of Whelon Road. NWS photograph.



Fig. 10. Aerial view of the damage seen in Figures 7, 8, and 9. A residence is at the top of the picture, and a guest house is near the bottom. Most of the downed trees are aligned in a southwest to northeast direction indicating the strongest, most damaging winds blew from the south or southwest. Arrows point toward trees uprooted and toppled by wind with a predominant westerly component. Photograph courtesy of *The Greenville News*.





Fig. 11. A view across the pond on the east side of Whelon Road. Note the root balls of uprooted trees on the distant shore. NWS photograph.



Fig. 12. Destroyed structure (probably a barn) on the east side of Whelon Road approximately 200 yards northeast of the damaged guest house pictured in Figure 9. View is toward the northeast. NWS photograph.

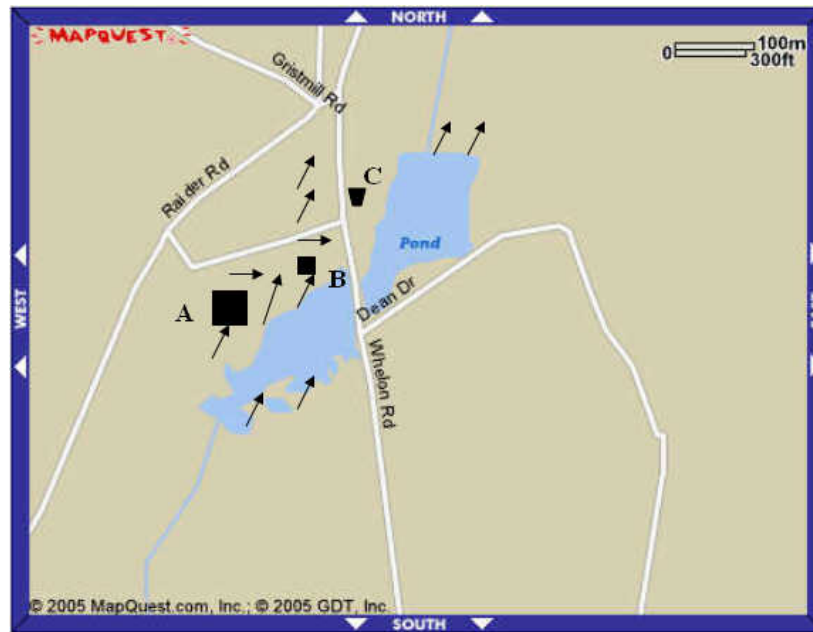


Fig. 13. Schematic diagram of the area pictured in Figures 7-12. Arrows represent direction in which downed trees are oriented. A and B represent the two houses seen in Figure 10. C identifies the destroyed barn seen in Figure 12.

Significant tree damage was observed for several hundred yards along Whelon Road north of the location pictured in Figure 12. The damage path, which was oriented northeast/southwest, departed the north/south oriented road. However, an aerial survey by local officials confirmed that tree damage existed nearly continuously to a residential area on Welcome Church Road. Access to the Welcome Church Road damage was prohibited by local officials on the day of the survey, but the Laurens County Emergency Management office reported that four mobile homes were damaged and a frame house suffered minor roof damage.



Fig. 14. Destroyed mobile home on Welcome Church Road. The steps and rectangular grass-free area identify the original location of the structure just above the truck. Photograph courtesy of WYFF-TV.



The tree damage and the debris pictured in Figure 14 clearly indicate the wind encountered the mobile home nearly broadside. This orientation resulted in an optimum situation for displacing and moving the structure, particularly if it was not anchored to the ground.

Local Emergency Management officials report the storm track ended approximately 200 to 300 yards north of S.C. 14 just beyond the Welcome Church Road damage. The width of the damage path near the end of this track was estimate to be 100 yards. No other wind damage occurred until the storm affected the TNT Logistics facility. Some trees were blown down on the plant property, but the most important damage was to the roof of the structure. Apparently, the lifting of the roof contributed to the development of a fire that engulfed a large part of a warehouse area. No other damage was reported or discovered although insulation, apparently from the roof of the warehouse, was carried by the storm as far northeast as the community of Lanford which is about 5 miles from the plant. The only known injury related to the storm occurred at TNT Logistics. According to the Laurens County Emergency Management Coordinator, the injury was minor.



Fig. 15. Fire smoldering at the TNT Logistics facility on the day after the storm. Photograph courtesy of WYFF-TV.

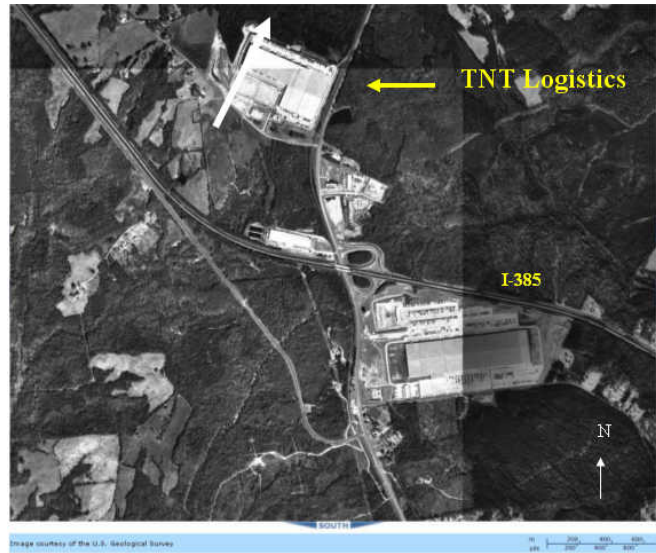


Fig. 16. Aerial view of the TNT Logistics area. White arrow identifies approximate track and direction of storm motion. (Image courtesy USGS and TerraServer-USA)

Shortly after the storm, a report of damage (“road closed due to weather debris”) along U.S. 221 near the Spartanburg County line was received. However, the survey on the day after the storm was unable to document the damage. An individual in a small grocery store in Enoree (Spartanburg County) was not aware of storm damage. Firemen at the Enoree Fire and Rescue Station also were not aware of damage. The fireman said that a crew was called out the previous night when a vehicle was reported to have been blown off the road near Antioch Church north of Enoree on U.S. 221.

## 2. Assessment of Storm Character and Intensity

The damage in the Ekom community is determined to be F0 tornado damage. The nature of the damage is known only from public reports, but the WSR-88D identified a strong mesocyclone accompanied by a TVS as the thunderstorm moved across that part of Laurens County.

The long track portion of the storm consisted of mostly F0 and F1 damage. However, there were at least two locations (just east of Laurens High School and near Welcome Church Road) where mobile homes were completely destroyed. Also, many large deciduous trees barren of leaves were uprooted. This mobile home and tree damage is consistent with F2 intensity on the Fujita scale of tornado intensity. The WSR-88D TVS persisted along this portion of the storm track.

The damage to the TNT Logistics facility and nearby trees is determined to be F1 tornado damage. The WSR-88D TVS had weakened at this point, but it reappeared when the storm was approaching Enoree in extreme southern Spartanburg County. No evidence of wind damage has been found along the remainder of the storm’s track through Laurens County into Spartanburg County. However, reports were received at the WFO shortly

after the event that storm debris was on the road somewhere along U.S. 221 near the Spartanburg County line.

Nearly all of the debris scattering was unidirectional (southwest to northeast). This is consistent with the damage to be expected with a cyclonic circulation traveling at a fairly rapid speed. The mesocyclone translational velocity determined from the radar was toward the northeast at 45 mph. A vortex at the low end of the F2 category would require a 68 mph tangential wind speed on the right side (relative to the direction of motion) to produce a total wind of 113 mph. The ground relative wind on the left side of such a circulation would be only 23 mph which is not sufficient to uproot trees and cause structural damage.

A vortex in the middle of the F2 category (135 mph) moving at 45 mph would have a tangential velocity of about 90 mph. The ground relative wind on the left side of the storm track in this case would be approximately 45 mph – not fast enough to cause significant damage.

The maximum wind speed in the F2 category is 157 mph. In this case, a 45 mph translational speed would result in a ground relative wind of 67 mph on the left side of the circulation. Wind damage would be expected to occur at 67 mph.

Very little evidence of wind damage on the left side of the circulation was discovered during the post-storm survey. (The distribution and orientation of downed trees near Whelon Road indicate strong and damaging westerly winds occurred on the back side of the tornado.) Therefore, it is assumed that ground relative winds on the left side of the storm track were in the low to middle range of wind speeds associated with the F2 category. Based on information available at the time of this writing, maximum ground relative wind speeds were likely in the 113 to 135 mph range.

The Fujita Scale of Tornado Intensity is on the next page.

### **3. End Note**

The judgments and conclusions made regarding the character of the storm damage and the tornado intensity are subject to refinement as additional information becomes available.

Acknowledgements: Mr. Ray Blackwell, Emergency Management Coordinator for Laurens County, provided important information used in compiling this assessment. Digital photographs from WSPA-TV, WYFF-TV, and *The Greenville News* were aids in documenting and assessing the event.



## Fujita Scale of Tornado Intensity

| F-Scale | Windspeed (mph) | Damage description   |
|---------|-----------------|--|
| F0      | 40-72           | Some damage to chimneys and TV antennae; breaks twigs off trees, pushes over shallow-rooted trees  |
| F1      | 73-112          | Peels surfaces off roofs; windows broken; light trailer houses pushed over or overturned; some trees uprooted or snapped; moving automobiles pushed off road   |
| F2      | 113-157         | Roofs torn off frame houses leaving strong upright walls; weak buildings in rural areas demolished; trailer houses destroyed; large trees snapped or uprooted; railroad boxcars pushed over; light object missiles generated; cars blown off highway |
| F3      | 158-206         | Roofs and some walls torn off frame houses; some rural building completely demolished; trains overturned; steel-framed hangar-warehouse type structures torn; cars lifted off the ground; most trees in a forest uprooted, snapped, or leveled       |
| F4      | 207-260         | Whole frame houses leveled, leaving piles of debris; steel structures badly damaged; trees debarked by small flying debris; cars and trains thrown some distance or rolled considerable distances; large missiles generated                          |
| F5      | 261-318         | Whole frame houses tossed off foundations; steel-reinforced concrete structures badly damaged; automobile-sized missiles generated; incredible phenomena can occur   |

- End -

LGL – 21 January 2005